The Chemical Nature of Matter

7-5 The student will demonstrate an understanding of the classifications and properties of matter and the changes that matter undergoes. (Physical Science)

7-5.5 Translate chemical symbols and the chemical formulas of common substances to show the component parts of the substances (including NaCl [salt], H_2O [water], $C_6H_{12}O_6$ [simple sugar], O_2 [oxygen gas], CO_2 [carbon dioxide], and N_2 [nitrogen gas]).

Taxonomy level: 2.1-B Understand Conceptual Knowledge

Previous/Future knowledge: Students have not been introduced to the concepts of chemical symbols and the chemical formulas in previous grades. Students will further develop the concepts of chemical symbols and chemical formulas in high school Physical Science (PS-4.5).

It is essential for students to know that *chemical symbols* show the atoms of the elements composing a substance. Symbols are written with one, two, or three letters. The first letter is always capitalized. Each element has a different symbol.

NOTE TO TEACHER: Students should know the symbols and names for the following common elements:

Element	Symbol
Sodium	Na
Chlorine	Cl
Hydrogen	H
Oxygen	O
Carbon	C
Nitrogen	N

- Elements are made up of one kind of atom and the symbol for each element is unique.
- Compounds are composed of more than one element and their formulas have more than one type of symbol showing the different elements that compose the compound.

Chemical formulas are constructed from the symbols of the elements composing the substances.

- In a chemical formula, the numbers as *subscripts* show how many of each kind of atom are in the compound.
- The subscript is written to the lower right of the element symbol.
- If no subscript is written, only one atom of that element is part of the compound. For example, in H_2O, the number 2 is the subscript for hydrogen and means that there are 2 atoms of hydrogen in the compound of water; since there is no subscript for oxygen it is assumed to be one atom of oxygen.

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NOTE TO TEACHER: Students should be able to recognize the common names of the substances listed in the indicator (table salt, water, simple sugar, oxygen gas, carbon dioxide, and nitrogen gas) and the names and symbols for the elements listed in the chart (above). For example, when students see the formula H_2O, they should be able to recognize that this is water.

It is not essential for students to memorize the symbols for the elements (other than those listed in the chart above) or interpret the chemical formulas for substances not listed in 7-5.5. Students do not need to know how to assign subscripts to elements or compounds.

Assessment Guidelines:
The objective of this indicator is to *translate* chemical symbols and chemical formulas of common substances listed above to show the component parts; therefore, the primary focus of assessment should be to interpret a chemical symbol and formula to identify the element(s) and the number of atoms of that element in a formula of the substance. However, appropriate assessments should also require students to *recognize* the chemical symbols and formulas of common substances; or *recall* the components.